FORM PTO-1390 (Modified) (REV 11-98) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)
112740-166	09/762733

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE99/02383	03 August 1999	12 August 1998

TITLE OF INVENTION

A METHOD, AND TRANSMISSION STATION, FOR DETERMINING THE OPERABILITY OF A RADIO CHANNEL IN A MOBILE RADIO COMMUNICATION SYSTEM

APPLICANT(S) FOR DO/EO/US

Michael Benz et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
9. ☒ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☒ Other items or information:

Submission of Drawings Fig.s. 1-3 on two sheets

U.S. APPLICATION NO. IF KNOWN SEE 37 CFR	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/762733	PCT/DE99/02383	112740-166

21. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

		CALCULATIONS	PTO USE ONLY
☐	Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO $1,000.00		
☒	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO $860.00		
☐	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $710.00		
☐	International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) $690.00		
☐	International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00		
	ENTER APPROPRIATE BASIC FEE AMOUNT =	**$860.00**	
	Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	**$0.00**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	10 - 20 =	0	x	**$0.00**	
Independent claims	2 - 3 =	0	x $78.00	**$0.00**	
Multiple Dependent Claims (check if applicable) .			☐	**$0.00**	
	TOTAL OF ABOVE CALCULATIONS =			**$860.00**	
	Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable) . ☐			**$0.00**	
	SUBTOTAL =			**$860.00**	
	Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +			**$0.00**	
	TOTAL NATIONAL FEE =			**$860.00**	
	Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). ☐			**$0.00**	
	TOTAL FEES ENCLOSED =			**$860.00**	
				Amount to be: refunded	$
				charged	$

☒ A check in the amount of **$860.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. in the amount of to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **02-1818** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

William E. Vaughan
Bell, Boyd & Lloyd LLC
P.O. Box 1135
Chicago, IL 60690-1135

SIGNATURE

William E. Vaughan
NAME

39,056
REGISTRATION NUMBER

February 12, 2001
DATE

BOX PCT

IN THE UNITED STATES ELECTED/DESIGNATED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

PRELIMINARY AMENDMENT

APPLICANTS:	Michael Benz et al.	DOCKET NO: 112740-166
SERIAL NO:		GROUP ART UNIT:
		EXAMINER:
INTERNATIONAL APPLICATION NO:		PCT/DE99/02383
INTERNATIONAL FILING DATE:		03 August 1999
INVENTION:		A METHOD, AND TRANSMISSION STATION, FOR DETERMINING THE OPERABILITY OF A RADIO CHANNEL IN A MOBILE RADIO COMMUNICATION SYSTEM

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

Please amend the above-identified International Application before entry into the National stage before the U.S. Patent and Trademark Office under 35 U.S.C. §371 as follows:

In The Specification:

On page 1, cancel lines 1-3 and substitute the following therefor:

--S P E C I F I C A T I O N

TITLE

A METHOD, AND TRANSMISSION STATION, FOR DETERMINING THE OPERABILITY OF A RADIO CHANNEL IN A MOBILE RADIO COMMUNICATION SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention--.

On page 1, line 5, insert --present-- before "invention".

On page 1, line 7, insert --mobile-- before "radio".

On page 1, lines 7-8, cancel ", especially in a mobile radio system. The invention also" and substitute therefor --and further--.

On page 1, line 9, insert --mobile-- before "radio".

On page 1, before line 14, insert the following left-hand justified heading: --**Description of the Prior Art**--.

On page 1, line 17, cancel "are" and substitute therefor --is--.

On page 1, line 26, cancel "by means of" and substitute therefor --via--.

On page 1, line 32, cancel ", therefore,".

On page 1, line 33, insert --either-- after "and".

On page 1, line 35, cancel "especially" and substitute therefor --particularly--.

On page 2, line 2, cancel the ",".

On page 3, line 16, insert a --,-- after "and".

On page 3, line 17, insert a --,-- after "case".

On page 3, line 26, cancel "to observe" and substitute therefor --also--.

On page 3, line 29, insert a --,-- after "over".

On page 3, line 29, insert a --,-- after "case".

On page 4, line 9, cancel "In consequence" and substitute therefor --As such--.

On page 4, line 24, insert a --,-- after "can".

On page 4, line 24, insert a --,-- after "thus".

On page 4, line 27, insert --both-- before "existing".

On page 4, line 27, cancel "also in".

On page 4, line 29, cancel ", from" and substitute therefor --. From--.

On page 4, lines 29-30, cancel "in each case".

On page 4, line 30, cancel "which" and substitute therefor --these--.

On page 4, line 31, insert a --,-- after "crystals".

On amended page 5, line 1, insert --matches a first radio channel at a first earlier time and matches a second radio channel at a second, later time. The first-- before "and".

On amended page 5, line 2, cancel "and" and substitute therefor a --,--.

On amended page 5, line 3, cancel "which".

On amended page 5, line 25, cancel ", this" and substitute therefor --. This--

.

On amended page 5, line 25, cancel "being" and substitute therefor --is--.

On amended page 5, line 26, cancel "by means of" and substitute therefor --via--.

On amended page 5a, line 2, cancel the "," and substitute therefor a --;--.

On amended page 5a, line 2, insert a --,-- after "example".

On amended page 5a, line 3, cancel "the" before "object" and substitute therefor --an--.

On amended page 5a, line 3, insert --, therefore,-- after "invention".

On amended page 5a, cancel lines 9-13 and substitute the following centered heading therefor:

--<u>SUMMARY OF THE INVENTION</u>--.

On amended page 5a, line 14, cancel "In" and substitute therefor --Accordingly, in--.

On amended page 5a, line 14, insert --present-- before "invention".

On amended page 5a, line 21, cancel "also".

On page 6, line 1, cancel "can".

On page 6, line 1, insert --can-- after "also".

On page 6, line 1, cancel "the" and substitute therefor --various--.

On page 6, line 2, cancel "according to" and substitute therefor --of--.

On page 6, line 2, insert --present-- before "invention".

On page 6, line 4, cancel "can".

On page 6, line 4,insert --can-- after "also".

On page 6, line 12, insert --present-- before "invention".

On page 6, line 25, cancel "recurs" and substitute therefor --occurs--.

On page 6, line 37, cancel "plurality" and substitute therefor --number--.

On page 7, line 3, cancel "can".

On page 7, line 4, insert --can-- after "then".

On page 7, line 13, cancel "or" after "reached" and substitute therefor a --,--

On page 7, line 20, cancel "a further development" and substitute therefor --another embodiment--.

On page 7, line 21, insert --either-- after "established".

On page 7, line 24, cancel "or" and substitute therefor a --,--.

On page 7, lines 31-32, cancel "or none".

On page 7, line 32, cancel "or" after "reached" and substitute therefor a --,--

On page 8, line 6, insert --present-- before "invention".

On page 8, line 7, cancel "plurality" and substitute therefor --number--.

On page 8, line 32, cancel the "," and substitute therefor a --;--.

On page 8, line 32, insert a --,-- after "i.e.".

On page 8, line 34, cancel "plurality" and substitute therefor --number--.

On page 8, line 34, cancel the "," and substitute therefor a --;--.

On page 8, line 35, insert a --,-- after "example".

On page 9, line 5, insert a --,-- after "and".

On page 9, line 5, insert a --,-- after "case".

On page 9, line 10, insert a --,-- after "station".

On page 9, line 30, insert a --,-- after "entered".

On page 9, line 30, insert a --,-- after "case".

On page 9, line 33, cancel the "," and substitute therefor a --;--.

On page 9, line 33, insert a --,-- after "example".

On page 10, cancel lines 2-6 and substitute the following therefor:

--Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Preferred Embodiments and the Drawings.

DESCRIPTION OF THE DRAWINGS--.

On page 10, line 9, cancel the "," and substitute therefor a --;--.

On page 10, line 12, cancel the "," and substitute therefor a --;--.

On page 10, before line 16, insert the following centered heading:

--**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**--.

On page 10, line 31, cancel "figure" and substitute therefor --Figure--.

On page 11, line 12, insert a --,-- after "is".

On page 11, line 12, insert a --,-- after "case".

On page 11, line 16, insert a --,-- after "group".

On page 12, line 2, insert a --,-- after "are".

On page 12, line 2, insert a --,-- after "case".

On page 12, line 13, cancel ", the" and substitute therefor --. The--.

On page 12, line 14, cancel "extending" and substitute therefor --extends--.

On page 12, line 21, insert a --,-- after "is".

On page 12, line 21, insert a --,-- after "case".

On page 12, line 29, cancel "then".

On page 12, line 29, insert --then-- after "station".

On page 12, line 32, cancel "and".

On page 12, line 33, cancel "which, by" and substitute therefor --. By--.

On page 12, line 35, insert --the valuation program-- before "establishes".

On page 12, line 36, cancel "i.e." and substitute therefor --or--.

On page 13, line 12, cancel "figure" and substitute therefor --Figure--.

On page 13, line 17, cancel "beings" and substitute therefor --that--.

On page 14, line 3, cancel "figure" and substitute therefor --Figure--.

On page 14, line 7, insert a --,-- after "used".

On page 15, line 18, cancel "figure" and substitute therefor --Figure--.

On page 15, line 26, cancel "figure" and substitute therefor --Figure--.

On page 15, line 29, cancel "figure" and substitute therefor --Figure--.

On page 15, line 33, cancel "can".

On page 15, line 33, insert --can-- after "also".

On page 16, line 1, cancel the "," and substitute therefor a --;--.

On page 16, line 1, insert a --,-- after "example".

On page 16, line 9, insert a --,-- after "are".

On page 16, line 9, insert a --,-- after "case".

On page 16, line 14, cancel "figure" and substitute therefor --Figure--.

On page 16, line 35, cancel "can".

On page 16, line 35, insert --can-- after "also".

On page 17, line 13, cancel "comprising" and substitute therefor --having--.

On page 17, line 14, insert a --,-- after "observes".

On page 17, line 14, insert a --,-- after "11".

On page 17, line 24, cancel "plurality" and substitute therefor --number--.

On page 17, line 26, cancel "is" and substitute therefor -- are--.

On page 17, lines 31-32, cancel ", respectively,".

On page 18, line 11, cancel "can".

On page 18, line 11, insert --can-- after "also".

On page 18, after line 15, insert the following paragraph:

--Although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.--

On page 22 (last page), cancel lines 1-3, and substitute the following centered heading therefor:

--**ABSTRACT OF THE DISCLOSURE**--.

On page 22, line 5, cancel "The invention relates to the determination of" and substitute therefor --A method, and transmission station, for determining--.

On page 22, lines 11-13, cancel ". The invention also relates to a corresponding transmitting and/or receiving station. Inoperable" and substitute therefor --, wherein inoperable--.

On page 22, line 15, cancel "(TS/f)" .

On page 22, cancel line 17.

In the Claims:

On page 19, cancel line 1, and substitute the following left-hand justified heading therefor:

--**We Claim As Our Invention:**--.

Please cancel claims 1-10, without prejudice, and substitute the following claims therefor:

11. A method for determining operability of at least one radio channel in a mobile radio communication system, the method comprising the steps of:

observing the at least one radio channel as an observed radio channel;

establishing an operating state of the observed radio channel at least one of continuously in time and repeatedly over a number of successive frames; and

evaluating a resultant history of the operating state to determine the operability of the observed radio channel.

12. A method for determining operability of at least one radio channel in a mobile radio communication system as claimed in claim 11, the method further comprising the step of:

determining a mean value of the operating state over a period of observation during the step of evaluating the resultant history.

13. A method for determining operability of at least one radio channel in a mobile radio communication system as claimed in claim 11, the method further comprising the step of:

determining a measured value characteristic of the operating state of the observed radio channel during the step of establishing the operating state.

14. A method for determining operability of at least one radio channel in a mobile radio communication system as claimed in claim 13, the method further comprising the step of:

determining whether the measured value has one of reached, exceeded and undershot a predetermined limit value in a period of observation during the step of evaluating the resultant history.

15. A method for determining operability of at least one radio channel in a mobile radio communication system as claimed in claim 13, wherein a short-time fluctuation of the measured value remains unconsidered in the step of evaluating the resultant history.

16. A method for determining operability of at least one radio channel in a mobile radio communication system as claimed in claim 11, the method further comprising the steps of:

establishing the respective operating state of a plurality of observed radio channels; and

determining a correlation of a development of the operating state of at least some of the observed radio channels with time during the step of evaluating the resultant history.

17. A method for determining operability of at least one radio channel in a mobile radio communication system as claimed in claim 16, wherein the radio channels are physical channels of a TDMA (Time Division Multiple Access) radio communication system and a temporal drift of a radio channel is established

from the correlation of the development of observed radio channels of a same radio frequency with time.

18. A method for determining operability of at least one radio channel in a mobile radio communication system as claimed in claim 11, the method further comprising the steps of:

establishing, repeatedly, a measure of the operating state; and

storing a corresponding value in a data field of a data memory for storing a development of the operating state with time.

19. A method for determining operability of at least one radio channel in a mobile radio communication system as claimed in claim 11, wherein the radio channels are physical channels of a TDMA (Time Division Multiple Access)/FDMA (Frequency Division Multiple Access) radio communication system and the operating state of each available radio channel is one of known and established by observing the at least one observed radio channel.

20. A transmission station for a mobile radio communication system, for at least one of transmitting and receiving communication information transmitted via an air interface, comprising:

a receiving device via which at least one observed radio channel, which is currently not used for one of transmitting and receiving the communication information, can be observed by establishing its operating state at least one of continuously in time and repeatedly over a number of successive frames;

a storage device for storing values which reproduce a history of the operating state of the at least one observed radio channel resulting from establishing the operating state; and

an evaluation device for determining operability of the observed radio channel for at least one transmitting and receiving the communication information by evaluating the history of the operating state.

REMARKS

The present amendment makes editorial changes and corrects typographical errors in the specification in order to conform the specification to the requirements of the United States Patent practice. No new matter is added thereby. Original claims 1-10 have been canceled in favor of new claims 11-20. Claims 11-20 have been presented solely because the revisions by bracketing and underlining which would have been necessary in claims 1-10 in order to present those claims in accordance with preferred United States Patent practice would have been too extensive, and thus would have been too burdensome. The amendment is intended for clarification purposes only and not for substantial reasons related to patentability pursuant to 35 U.S.C. §§101, 102, 103 or 112. Indeed, the cancellation of claims 1-10 does not constitute an intent on the part of the Applicants to surrender any of the subject matter of claims 1-10.

Early consideration on the merits is respectfully requested.

Respectfully submitted,

(Reg. No. 39,056)

William E. Vaughan
Bell, Boyd & Lloyd LLC
P.O. Box 1135
Chicago, Illinois 60690-1135
(312) 807-4292
Attorneys for Applicants

2/PRTS

09/762733
JC02 Rec'd PCT/PTO 12 FEB 2001

Description

Determination of the operability of a radio channel

The invention relates to a method for determining the operability of at least one radio channel in a radio communication system, especially in a mobile radio system. The invention also relates to a transmitting and/or receiving station for a radio communication system, especially a base station or a mobile station for a mobile radio system, for transmitting and/or receiving communication information which is transmitted via an air interface.

It is known to use physical channels for transmitting communication information in radio communication systems. The communication information, especially speech data or computer data, are transmitted from a transmitting station to a receiving station via an air interface by using these physical channels. Parameters of the physical channels are, for example, a certain timeslot in a TDMA (Time Division Multiple Access) radio communication system, a certain carrier frequency which is used during the transmission of the communication information in an FDMA (Frequency Division Multiple Access) radio communication system and a certain code by means of which the communication information is coded for radio transmission in a CDMA (Code Division Multiple Access) radio communication system. Combinations of the known multiple access methods TDMA, FDMA and CDMA are possible. In a combined TDMA, FDMA radio communication system, for example, a physical radio channel is, therefore, defined by its timeslot and its radio frequency or carrier frequency, respectively.

In known mobile radio systems, especially in the global system for mobile telecommunication (GSM), the radio channels via which communication information

can be transmitted between a certain base station and a certain mobile station, are issued centrally via a coordination unit. The coordination unit selects the individual control units of the base stations operated in the GSM and assigns the radio channels to them.

However, radio communication systems are also known which operate in so-called uncoordinated mode. In such systems, the radio channels are not issued centrally for the entire system but, instead, the stations involved in a radio link select their own radio channels from an existing pool of available radio channels. An example of a station operating in uncoordinated mode is the mobile station of a mobile radio system according to the DECT standard.

If the mobile station notices, for example, that the bit error rate on a receive channel has exceeded a permissible limit value, it selects a radio channel from a list of available radio channels and initiates a change from the previously used radio channel to the selected radio channel. The change is performed with the aid of known, established protocols according to which signaling information is exchanged between the mobile station and the associated base station.

It is also known that such a list, which contains data on the operability of available radio channels, is generated in accordance with the following method: at least one observed radio channel which is currently not used for transmitting or receiving the communication information, in the transmission of which the transmitting and/or receiving station is involved, is observed via a receiving device of a transmitting and/or receiving station. To observe the observed radio channel, the received field strength is measured via a receiver which is tuned to the observed radio channel. The received field strength generally has a

value of greater than zero. Reasons for this are, for example, interference due to radio channels at the same or approximately the same frequency which are used on other transmission links of the same radio communication system or another radio communication system, other interference signals which arrive at the receiving device at the set frequency, or a level of background noise which is inherent in the receiving device and/or a downstream device. For this reason, a maximum value for the field strength is established which is allowed to be reached at a maximum during the measurement of the observed radio channel. If the field strength exceeds this maximum value, the observed radio channel is marked as occupied or inoperable in the list of operable radio channels. To update the list, the measurement of the field strength is repeated and in each case another check is made as to whether the maximum value is exceeded. Correspondingly, the entry in the list is updated with each measurement, in such a manner that it is always the result of the last most current measurement which is entered in the list.

It is known also to make the selection of a radio channel in the same manner described above if there if no radio link as yet but is only to be set up. It is also known to observe not only one observed radio channel but to observe all available radio channels which are currently not used themselves by the measuring station. Thus, for example, a total of 120 physical channels distributed over in each case 12 timeslots of 10 carrier frequencies are available for the downlink from a base station to a mobile station in a radio communication system according to the DECT standard. In this TDMA/FDMA-based system, a mobile station, therefore, must observe up to 120 physical channels.

It is known, especially from communication based on fixed lines, in which communication information is transmitted via fixed

transmission lines such as optical fiber cables or copper cables, to subdivide the communication information into individual information packets in each case and to transmit the information packets in succession at time intervals via the fixed lines. For future radio communication systems such as, for example, the universal mobile telecommunication system (UMTS), it is being considered also to allow the transmission of information packets. In consequence, it is possible that communication information will only be transmitted from time to time on some or all radio channels used. Furthermore, there will be only a low electrical field strength, at least from time to time, even on radio channels which are being used in this case. In the known method for determining the operability of a radio channel in which a conclusion about the operability is in each case drawn from the last measurement of the field strength of an observed radio channel, wrong conclusions can, therefore, be obtained. If the last measurement of the field strength of an observed radio channel takes place precisely in the transmission interval between two transmitted information packets, it is erroneously found that the observed radio channel is available and can thus be used for a new radio link to be set up or an existing one.

In existing and also in future radio communication systems, oscillator crystals are used in the transmitting and/or receiving stations, from the in each case constant frequency of oscillation of which crystals the time base for a TDMA multiple access system is derived. In practice, however, the frequencies of oscillation of the individual oscillator crystals used in the system are not exactly of the same magnitude. For this reason, it frequently happens that used radio channels appear to be drifting in time from the point of view of a transmitting and/or receiving station which is observing observed radio channels

matches a first radio channel at a first earlier time and matches a second radio channel at a second, later time. The first and the second radio channel are radio channels which are different from one another and are available to the observing station and which are allocated to different timeslots of the same carrier frequency. From the point of view of the observing station, therefore, the radio channel external to the station drifts over its own timeslots in time.

It is the object of the present invention to specify a method for determining the operability of at least one observed radio channel in a radio communication system, especially in a mobile radio system, by means of which the operability of the observed radio channel can be determined as reliably as possible. Furthermore, it is the object of the present invention to specify a transmitting and/or receiving station for a radio communication system, especially a base station or a mobile station for a mobile radio system which can determine the operability of an observed radio channel with the greatest possible reliability.

The object is achieved by a method having the features of claim 1 and, respectively, by a transmitting and/or receiving station having the features of claim 10. Further developments are the subject matter of the dependent claims.

In the method according to the invention, the at least one radio channel, the operability of which is to be determined, is an observed radio channel, the operating state of which is established continuously in time and/or repeatedly. The operability of the observed radio channel is determined by evaluating the history of the operating state. It is thus possible, especially also in the case of radio channels drifting in time, to reliably determine the operability of the at least one observed radio channel. Furthermore, the utilization of a radio channel for the transmission of information

packets can also be reliably established. In the embodiments of the method according to the invention, the history is evaluated in different manners, in which individual types of evaluation can also be combined with one another. In each case, information on the past of the operating state is available in the determination of the operability of the observed radio channel so that, for example, the change of an existing radio link to another radio channel not otherwise used is possible with great reliability.

In an embodiment of the method according to the invention, a mean value of the operating state is determined over a period of observation in the evaluation of the history. If the period of observation is, for example, one minute, counted in each case from the time of the most current recent determination of the operating state, and if the operating state is established continuously in time and/or repeatedly in the period of observation, radio channels used for the transmission of information packets can be reliably determined. In a further development, mean values of the operating state are determined over a plurality of periods of observation following one another. In this manner, frequency of a disturbance of a radio channel which recurs at irregular intervals can be additionally determined, for example. If a disturbance occurs, for example, only once in a long overall period of observation, the corresponding observed radio channel can still be marked as operable since a further disturbance is not probable and/or since any further disturbance will not be important. The communication information transmitted during such a further disturbance can be retransmitted by the transmitting station, for example on request by the receiving station, so that the transmission is complete overall.

As an alternative or in addition to forming a plurality of mean values over successive periods of observation,

a multiplicity of individual values of the operating state relating to successive times of observation is determined in another embodiment. The evaluation can then be made in a similar manner as in the case of the mean values.

In a preferred embodiment, the value of a measured value characteristic of the operating state of the respective observed radio channel is determined in the establishment of the operating state. Thus, measured values exist which can be compared, for example, with a limit value. In a further development, it is established during the evaluation of the history whether the measured value has reached or exceeded or undershot a predetermined limit value in a period of observation. If this is so, the observed radio channel, for example, is marked as inoperable. As an alternative, the observed radio channel can only be marked as inoperable after the limit value has been reached or exceeded or undershot several times. Furthermore, in a further development, it is established as an alternative or additionally whether a mean value of the characteristic measured value over a period of observation, or a number of mean values over in each case one period of observation, have reached or exceeded or undershot the predetermined limit value or a second predetermined limit value. If the operability of a radio channel is to be determined with especially high reliability in this further development, no individual measurement value must have reached or exceeded or undershot the limit value in a first, shorter period of observation and the mean value or none or the mean values must have reached or exceeded or undershot the second predetermined limit value in a second, longer period of observation. Meaningful values for the length of the predetermined periods of observation are, for example, 3 seconds for the first, shorter period and 10 seconds or 1 minute for the second, longer period of observation.

Here, too, it is advantageous if a single short-time fluctuation of the measured value remains unconsidered in the evaluation of the history. Reasons for this have already been mentioned above.

In a further embodiment of the method according to the invention, in which the operating state of a plurality of the observed radio channels is in each case determined, a correlation of the development of the operating state with time of at least a part of the observed radio channels is determined in the evaluation of the history. If a high correlation, for example of two or more radio channels, is found, which are physical channels of a TDMA (Time Division Multiple Access) radio communication system, a temporal drift of a radio channel can be determined from the correlation of the development of the observed radio channels with time which have the same radio frequency. Apart from the correlation of the development with time, the time interval between occurrences of interference signals on observed radio channels of the same frequency are observed and evaluated as an alternative or in addition. This procedure is based on the concept that the drift of a radio channel with time occurs at an approximately constant drift rate.

If such a constant drift rate with time is found, the presence of a radio channel drifting with time is concluded. Accordingly, either all radio channels affected by the drift are marked as inoperable or a precalculation is performed which radio channels will be inoperable in which period. In both cases, it is possible but not necessary that all radio channels of the same frequency are observed, i.e. are observed radio channels. Instead, it is sufficient to observe a plurality of the radio channels of the same frequency, for example three or four radio channels. The observed radio channels are preferably allocated successive timeslots of the common radio frequency.

The information which is found continuously in time and/or repeated during the observation of the at least one observed radio channel is preferably stored. In particular, a measure of the operating state is repeatedly established and in each case a corresponding value is stored in a data field of a data memory for storing the development of the operating state with time. The values stored in the data field can then be accessed, for example by an evaluating device provided in an observing transmitting and/or receiving station and the operability of the observed radio channel for transmitting and/or receiving communication information can be determined. The station preferably exhibits a receiving device via which the at least one observed radio channel can be observed which is currently not used for transmitting and/or receiving the communication information. The receiving device can be the same receiving device via which the communication information is received or there is, for example, a second receiving device so that it is possible to simultaneously observe and receive. In the first-mentioned case, for example, the receiving of the communication information at predetermined times or at times agreed with the transmitting station is interrupted so that an observation of the at least one observed radio channel takes place in the phases of interruption.

In a further development, there are registers into which the most current value established is entered in each case for an observed radio channel and, furthermore, there is a read-out unit which reads the current values from the registers. After that, the values read out are immediately evaluated, for example the exceeding of a limit value is checked and/or the values read out are written into a storage device for storing values which reproduce the history of the operational

state of the at least one observed radio channel.

Exemplary embodiments of the invention will now be explained in greater detail with reference to the attached drawing. However, the invention is not restricted to these exemplary embodiments. In the individual figures of the drawing:

Figure 1 shows a table with operable and inoperable radio channels of an FDMA/TDMA-based system,

Figure 2 shows a diagram with six measured values which reproduce the operating state of an observed radio channel, and

Figure 3 shows a base station and a mobile station in a mobile radio system.

Figure 1 shows a table of an FDMA/TDMA-based radio communication system which provides an overview of the operability of a total of 60 physical radio channels. The physical radio channels in each case correspond to a combination of a timeslot TS and a carrier frequency f. On each of the carrier frequencies f1...f6, communication information can be transmitted in 10 timeslots TS0...TS9.

In a variant, not shown, the radio communication system also exhibits a CDMA (Code Division Multiple Access) component. In this case, a three-dimensional table must be managed in order to have an overview of the operability of the radio channels.

The FDMA/TDMA system corresponding to the table shown in figure 1 is a system in which duplex links are set up and operated in each case between a base station and a mobile station of a mobile radio network. The respective downlink via which communication information is transmitted from the base station to the

mobile station, and the respective uplink via which communication information is transmitted from the mobile station to the base station, use different timeslots of the same carrier frequency. In this arrangement, there is a fixed association between the downlink radio channel and the associated uplink radio channel. In accordance with the fixed association, the timeslot of the downlink radio channel is always one of timeslots TS0...TS4 and the timeslot of the uplink radio channel is always one of timeslots TS5...TS9. Furthermore, the first timeslot TS0 of the first timeslot group TS0...TS4 is in each case associated with the first timeslot TS5 of the second timeslot group TS5...TS9, the second timeslot TS1 of the first timeslot group is associated with the second timeslot TS6 of the second timeslot group and so on. The mutually associated radio channels use the same carrier frequency f here, as already mentioned. In the case of duplex links, it is thus sufficient to observe only the radio channels available for downlinks or only the radio channels available for uplinks.

First exemplary embodiment

In a first exemplary embodiment, only these duplex links are operated in an observed radio communication system. A mobile station will now be considered which receives communication information from a base station on radio channel TS1/f6. Accordingly, the mobile station transmits communication information to the base station on radio channel TS6/f6.

To determine information for a change of channel in the case of a disturbance of at least one of the radio channels currently used by the mobile station, the mobile station repeatedly observes the operating state of all available downlink radio channels at regular intervals, with the exception of the radio channel TS1/f6 currently used by it.

For this purpose, the mobile station exhibits a multiplicity of receivers which are in each case set to a timeslot/frequency combination. Thus, they are at least (6×5)-1 receivers each. Each receiver is associated with a register in which the most current measured value in each case of the field strength of the respective radio channel measured by a test set is entered. The measured values stored in the registers are successively repeatedly read out in multiplex mode and written into a data memory. In the data memory, the measured values of the field strength from each of the observed radio channels over a period of observation with a length of 3 seconds are stored, the period of observation in each case extending into the past beginning from the time of the most current measurement.

With readout cycles which are constant in time and in which each register is read out once in each case, the predetermined length of the period of observation corresponds to a fixed number of storage spaces in a data field which is in each case allocated to one observed radio channel. In this arrangement, the value of a pointer variable marks for each data field the oldest measured value which is still stored. If a new measured value is entered again into the data field, the oldest measured value is overwritten and the pointer variable is sent to the next storage space following in the data field.

If then the mobile station notices a disturbance in the radio channel currently used for the transmission of communication information, for example due to an intolerably high bit error rate, and a valuation program is started which, by evaluating the measured values stored in the individual data fields, establishes whether an observed radio channel is unoccupied, i.e. not otherwise used in the mobile radio system, or is disturbed in another manner.

In a variant of the first exemplary embodiment, the associated base station conducts corresponding measurements and,

in the case of a disturbance, a fast exchange of information takes place between base station and mobile station in order to determine a pair of operable mutually associated radio channels for a duplex link. In a second variant, the mobile station concludes from the operability of a downlink radio channel that the associated uplink radio channel is also operable.

Neither of the two variants require that the history of all observed radio channels be evaluated. Instead, it is sufficient to continue the evaluation until an idle radio channel has been found.

In the table of figure 1, the radio channels otherwise used or disturbed at the time of the disturbance are marked by gray shading of the respective fields. However, the mobile station does not carry a complete list of the radio channels currently used or disturbed but only beings to evaluate the measured values stored in the data fields of the data memory in the case of a disturbance. It begins with radio channel TS0/f1 in which it establishes that the radio channel is otherwise used. The mobile station thus continues the evaluation with radio channel TS1/f1 and establishes that this radio channel is operable. It initiates the change of radio channels from TS1/f6 to TS1/f1 (downlink) and from TS6/f6 to TS6/f1 (uplink). Correspondingly, the radio link can be continued essentially without noticeable interruption.

Second exemplary embodiment

The method according to the second exemplary embodiment is preferred for operational situations in which the evaluation of the history would take too long if it is only begun in the case of a disturbance. In distinction from the first exemplary embodiment, the evaluation program evaluates the total available development of the observed radio channel with time in each case after the updating of a data field

by writing in a new measured value and enters a corresponding mark into a table which corresponds to the table shown in figure 1. There are two possibilities for marking in this case. Either the evaluation comes to the conclusion that the respective radio channel is currently undisturbed or not otherwise used or it comes to the conclusion that the radio channel is disturbed or otherwise used. If the evaluation leads to the same result as the evaluation last performed for the same radio channel, the marked value in the table does not need to be changed.

The mobile station receives the marked values for the uplink radio channels either from the base station or it concludes from the disturbance of a downlink radio channel that the associated uplink radio channel is also disturbed. The complete table of uplink and downlink radio channels needs to be managed only either by the mobile station or by the base station.

In a variant, the complete table, therefore, is only managed in the base station and the mobile station only manages a table which covers timeslots TS0...TS4. Furthermore, no mark needs to be entered in the table for the uplink radio channel belonging to the currently used downlink radio channel. The information about which uplink radio channel is currently used is available, in any case.

On the other hand, it is of advantage in many operational situations to manage the complete list of the disturbed or inoperable uplink and downlink radio channels since conclusions can be drawn from the undisturbed state of an associated uplink radio channel in the evaluation of the history of a possibly disturbed downlink radio channel. This is because, for example, if only a single measured value of the field strength of the downlink radio channel is above the predetermined limit value and if the associated uplink radio channel is not

disturbed, this single measured value will not be taken into consideration and the downlink radio channel will be marked as idle.

In another variant, trust is put in the fixed association of the duplex radio channels and only the list of downlink radio channels or the list of uplink channels is managed.

An example of the evaluation of the history of the operating state will now be given with reference to figure 2.

Third exemplary embodiment

Figure 2 shows a total of six measured values for the field strength E which is measured in an observed radio channel. The field strength is measured at regular intervals or, respectively, a register which contains the current measured values of the field strength is read out at regular intervals.

In the representation of figure 2, both the field strength E and the time t are plotted in arbitrary units. The unit of time corresponds to the time interval between the measured values.

In the evaluation of the history which is reproduced by the measured values, a check is made as to whether the measured values exceed the permissible maximum value E_G of the field strength. In the case shown in figure 2, only the fifth measured value exceeds the maximum value E_G. Furthermore, the mean value of all measured values taken in the period of observation shown is represented in figure 2. The mean value is represented by a continuous horizontal line, for example at E=2.25. The mean value is distinctly below the maximum value E_G. Apart from comparing it with the maximum value E_G, the mean value can also be assessed by calculating the variance of the measured values in the period of observation and by comparing it with a second lower maximum value for the mean field strengths.

The observed radio channel is marked, for example as operable or inoperable in dependence on this assessment.

In the third exemplary embodiment, the following criteria for the operability of the observed radio channel apply:

- None of the measured values in the period of observation can exceed the maximum value E_G.
- Mean values are in each case formed for equally long successive periods of observation of lengths t=6. None of these mean values can exceed a second predetermined maximum value for the mean field strengths in the period of observation.

In the case shown in figure 2, the first criterion is not met so that the associated observed radio channel is marked as inoperable. However, the mean value is below the second limit value for the mean field strength in the period of observation shown. If, therefore, no measurement value above the maximum value E_G is established in following periods of observation and if a mean value below the second limit value for the mean field strength is also found in the following periods of observation, both criteria are met so that the mark can be changed to "operable". For the rest, the procedure is exactly the same as in the first exemplary embodiment or the second exemplary embodiment.

The criteria in the third exemplary embodiment were selected as described above in order also to be able to establish the transmission of information packets on the observed radio channel. The first criterion mentioned takes account of the irregular transmission of information packets in time. The fact that a single measured value which exceeds the maximum value E_G can also be a freak value or measuring error, is taken into account by the second criteria. Thus, a practicable compromise has been found between the demand of reliably establishing the operability of

an observed radio channel, on the one hand, and a demand always to have a spare operable radio channel, if at all possible, on the other hand.

Figure 1 shows a base station 2 of a mobile radio system which is connected to a control processor for controlling the base station 2. Furthermore, the base station 2 is connected to an antenna device 1 for transmitting and receiving communication information via an air interface 5 to a multiplicity of mobile stations.

Representative of the multiplicity of mobile stations, one mobile station 10 is shown in Figure 3. The mobile station 10 exhibits a receiving device 13 comprising an antenna device 11 and a register 12. The receiving device 13 observes via the antenna device 11 at least one observed radio channel which is currently not used for transmitting or receiving communication information. For this purpose, the receiving device 13 measures the field strength of the observed radio channel and stores the most current measured value in each case in register 12.

Furthermore, the mobile station 10 exhibits a readout and storage device 14 for reading out and storing at regular time intervals the measured values stored in the register 12. A plurality of measured values read out which correspond to successive measurement times is stored in the readout and storage device.

Furthermore, an evaluating device 15 which, if necessary, that is to say in the case of a disturbed radio channel which is currently used for transmitting or receiving communication information to or, respectively, from the mobile station 10, before a radio link of the mobile station 10 is set up and/or continuously during an existing radio link, evaluates the history of the measured values for the field strength of the observed radio channel in order to determine the operability of the observed radio channel,

is provided in the mobile station 10. The mobile station 10 can be operated, in particular, in accordance with one of the exemplary embodiments described above.

The exemplary embodiments of the invention described are particularly suitable for the so-called uncoordinated operation in a future mobile radio system, for example the universal mobile telecommunication system (UMTS) in the TDD (Time Division Duplex) mode of operation. However, the invention can also be advantageously used in other systems, for example in systems which are operated in accordance with the DECT standard, the transmission of packet information also being permitted in distinction from the currently used mode of operation.

Patent Claims

1. A method for determining the operability of at least one radio channel in a radio communication system, especially in a mobile radio system, the at least one radio channel being an observed radio channel, the operating state of which is established continuously in time and/or repeatedly and in which the operability of the observed radio channel is determined by evaluating the history of the operating state.

2. The method as claimed in claim 1, in which a mean value of the operating state is determined over a period of observation in the evaluation of the history.

3. The method as claimed in claim 1 or 2, in which the value of a measured value (E) characteristic of the operating state of the respective observed radio channel is determined in the establishment of the operating state.

4. The method as claimed in claim 3, in which it is established during the evaluation of the history whether the measured value (E) has reached or exceeded or undershot a predetermined limit value in a period of observation.

5. The method as claimed in claim 3 or 4, in which a short-time fluctuation of the measured value (E) remains unconsidered in the evaluation of the history.

6. The method as claimed in one of claims 1 to 5, in which the operating state of a plurality of the observed radio channels is in each case established and in which a correlation of the development of the operating state of at least some of the observed radio channels with time is determined in the evaluation of the history.

7. The method as claimed in claim 6, in which the radio channels are physical channels of a TDMA (Time Division Multiple Access) radio communication system and in which a temporal drift of a radio channel is established from the correlation of the development of observed radio channels with time which have the same radio frequency.

8. The method as claimed in one of claims 1 to 7, in which a measure of the operating state is repeatedly established and in each case a corresponding value is stored in a data field of a data memory for storing the development of the operating state with time.

9. The method as claimed in one of claims 1 to 8, in which the radio channels are physical channels of a TDMA (Time Division Multiple Access)/FDMA (Frequency Division Multiple Access) radio communication system and in which the operating state of each available radio channel is known or is established by observing the at least one observed radio channel.

10. Transmitting and/or receiving station (10) for a radio communication system, especially a base station or mobile station for a mobile radio system, for transmitting and/or receiving communication information which is transmitted via an air interface (5), comprising

- a receiving device (13) via which at least one observed radio channel, which is currently not used for transmitting or receiving the communication information, can be observed by establishing its operating state continuously in time and/or repeatedly,
- a storage device (14) for storing values which reproduce the history of the operating state of the at least one observed radio channel, and

- an evaluation device (15) for determining the operability of the observed radio channel for transmitting and/or receiving the communication information by evaluating the history of the operating state.

and the second radio channel are radio channels which are different from one another and are available to the observing station and which are allocated to different timeslots of the same carrier frequency. From the point of view of the observing station, therefore, the radio channel external to the station drifts over its own timeslots in time.

From WO 97/47147, a radio telecommunication system is known in which a set of channels is provided both for radio telecommunication according to a cellular telecommunication system and radio telecommunication according to a cordless telecommunication system, in which a mobile part of the multimode radio communication system, in as much as it is not located in the radio coverage area of a base station of the cordless telecommunication system, is allocated to a base station of the cellular telecommunication system. If the mobile part moves into the radio coverage area of a cordless base station, the mobile part initiates a registration procedure for registering in this base station in which, among other things, a list with the channels not used by the cellular telecommunication system and thus available for cordless telecommunication is transmitted to the cordless base station, this channel list being determined by means of field strength measurements of the individual channels of the multimode radio telecommunication system in a state of the mobile part in which it does not maintain a radio link.

From US 5,453,666, a method in a system, in which frequencies (channels) from a frequency band both of a cellular telecommunication system and of a cordless telecommunication system are used is known in which a scanner of a cellular telecommunication system examines the channels for determining the frequencies available for the cellular telecommunication system, by measuring the field strength

of the channels sequentially and repeatedly until it is stopped, for example by a timer.

It is the object of the present invention to determine the operability of at least one radio channel in a radio communication system, especially in a mobile radio system for discontinuous information packets to be transmitted in the system or in radio channels which are drifting in time in the system.

The object is achieved by a method having the features of claim 1 and, respectively, by a transmitting and/or receiving station having the features of claim 10. Further developments are the subject matter of the dependent claims.

In the method according to the invention, the at least one radio channel, the operability of which is to be determined, is an observed radio channel, the operating state of which is established continuously in time and/or repeatedly. The operability of the observed radio channel is determined by evaluating the history of the operating state. It is thus possible, especially also in the case of radio channels drifting in time, to reliably determine the operability of the at least one observed radio channel. Furthermore, the utilization of a radio channel for the transmission of information

Patent Claims

1. A method for determining the operability of at least one radio channel in a radio communication system, especially in a mobile radio system, the at least one radio channel being an observed radio channel, characterized in that the operating state of which is established continuously in time and/or repeatedly over a number of successive frames and in which the operability of the observed radio channel is determined by evaluating the resultant history of the operating state.

2. The method as claimed in claim 1, in which a mean value of the operating state is determined over a period of observation in the evaluation of the history.

3. The method as claimed in claim 1 or 2, in which the value of a measured value (E) characteristic of the operating state of the respective observed radio channel is determined in the establishment of the operating state.

4. The method as claimed in claim 3, in which it is established during the evaluation of the history whether the measured value (E) has reached or exceeded or undershot a predetermined limit value in a period of observation.

5. The method as claimed in claim 3 or 4, in which a short-time fluctuation of the measured value (E) remains unconsidered in the evaluation of the history.

6. The method as claimed in one of claims 1 to 5, in which the operating state of a plurality of the observed radio channels is in each case established and in which a correlation of the development

of the operating state of at least some of the observed radio channels with time is determined in the evaluation of the history.

7. The method as claimed in claim 6, in which the radio channels are physical channels of a TDMA (Time Division Multiple Access) radio communication system and in which a temporal drift of a radio channel is established from the correlation of the development of observed radio channels of the same radio frequency with time.

8. The method as claimed in one of claims 1 to 7, in which a measure of the operating state is repeatedly established and in each case a corresponding value is stored in a data field of a data memory for storing the development of the operating state with time.

9. The method as claimed in one of claims 1 to 8, in which the radio channels are physical channels of a TDMA (Time Division Multiple Access)/FDMA (Frequency Division Multiple Access) radio communication system and in which the operating state of each available radio channel is known or is established by observing the at least one observed radio channel.

10. Transmitting and/or receiving station (10) for a radio communication system, especially a base station or mobile station for a mobile radio system, for transmitting and/or receiving communication information which is transmitted via an air interface (5), comprising

- a receiving device (13) via which at least one observed radio channel, which is currently not used for transmitting or receiving the communication information, can be observed by establishing its operating state continuously in time and/or repeatedly over a number of successive frames,

- a storage device (14) for storing values which reproduce the history of the operating state of the at least one observed

radio channel resulting from this establishing, and

- an evaluation device (15) for determining the operability of the observed radio channel for transmitting and/or receiving the communication information by evaluating the history of the operating state.

Abstract

Determination of the operability of a radio channel

The invention relates to the determination of the operability of a radio channel, especially in a mobile radio system, in which the operating state of the radio channel is established continuously in time and/or repeatedly and in which the operability of the observed radio channel is determined by evaluating the history of the operating state. The invention also relates to a corresponding transmitting and/or receiving station. Inoperable radio channels which are defined, for example, by a timeslot/frequency combination (TS/f), are marked.

(Figure 1)

BOX PCT

IN THE UNITED STATES ELECTED/DESIGNATED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

APPLICANTS: Michael Benz et al. DOCKET NO: 112740-166

SERIAL NO: GROUP ART UNIT:

EXAMINER:

INTERNATIONAL APPLICATION NO: PCT/DE99/02383

INTERNATIONAL FILING DATE: 03 August 1999

INVENTION: A METHOD, AND TRANSMISSION STATION, FOR DETERMINING THE OPERABILITY OF A RADIO CHANNEL IN A MOBILE RADIO COMMUNICATION SYSTEM

Assistant Commissioner for Patents,
Washington, D.C. 20231

SUBMISSION OF DRAWINGS

Applicants herewith submit two sheets (Figs. 1-3) of drawings for the above-referenced PCT application.

Respectfully submitted,

(Reg. No. 39,056)

William E. Vaughan
Bell, Boyd & Lloyd LLC
P.O. Box 1135
Chicago, Illinois 60690-1135
(312) 807-4292
Attorneys for Applicants

Declaration and Power of Attorney For Patent Application

Erklärung Für Patentanmeldungen Mit Vollmacht

German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Ermittlung der Nutzbarkeit eines Funkkanals

_____

_____

deren Beschreibung

(zutreffendes ankreuzen)

☒ hier beigefügt ist.

☐ am _____ als PCT internationale Anmeldung PCT Anmeldungsnummer _____ eingereicht wurde und am _____ abgeändert wurde (falls tatsächlich abgeändert).

the specification of which

(check one)

☐ is attached hereto.

☐ was filed on _____ as PCT international application PCT Application No. _____ and was amended on _____ (if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

German Language Declaration

Prior foreign appplications Priorität beansprucht			Priority Claimed	
198 36 575.6	Germany	12. August 1998	☒	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhangig, aufgegeben)	(Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents, Box PCT
United States Patent and Trademark Office
Washington, D.C. 20231
www.uspto.gov

U.S APPLICATION NO		FIRST NAMED APPLICANT	ATTY DOCKET NO
09/762733	BENZ	M	112740-166

INTERNATIONAL APPLICATION NO.
PCT/DE99/02383

1 A FILING DATE	PRIORITY DATE
03 AUG 99	12 AUG 98

WILLIAM E VAUGHAN
BELL BOYD & LLOYD
PO BOX 1135
CHICAGO, IL 60690 1135

DATE MAILED:

NOTIFICATION OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C. 371 AND 37 CFR 1.494 OR 1.495

1. The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as ☐ a Designated Office (37 CFR 1.494), ☒ an Elected Office (37 CFR 1.495), has determined that the above-identified international application has met the requirements of 35 U.S.C. 371, and is **ACCEPTED** for national patentability examination in the United States Patent and Trademark Office.

2. The United States Application Number assigned to the application is shown above and the relevant dates are:

05 April 2001	05 April 2001
DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS	DATE OF RECEIPT OF ALL 35 U.S.C. 371 REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE "FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** *The filing date of the above-identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363).* Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

3. ☒ A request for immediate examination under 35 U.S.C. 371(f) was received on 12 February 2001 and the application will be examined in turn.

4. The following items have been received:
- ☒ U.S. Basic National Fee.
- ☒ Copy of the international application.
- ☐ Translation of the international application into English.
- ☒ Oath or Declaration of inventors(s).
- ☐ Copy of Article 19 amendments. ☐ Translation of Article 19 amendments into English.
  The Article 19 amendments ☐ have ☐ not been entered.
- ☒ The International Preliminary Examination Report in English and its Annexes, if any.
- ☐ Copy of the Annexes to the International Preliminary Examination Report (IPER).
  ☐ Translation of Annexes to the IPER into English.
  The Annexes ☐ have ☐ not been entered.
- ☒ Preliminary amendment(s) filed 12 February 2001 and _____.
- ☒ Information Disclosure Statement(s) filed 12 February 2001 and _____.
- ☒ Assignment document.
- ☒ Power of Attorney and/or Change of Address.
- ☐ Substitute specification filed _____.
- ☐ Indication of Small Entity Status.
- ☒ Priority Document.
- ☒ Copy of the International Search Report ☐ and copies of the references cited therein.
- ☐ Other:

Applicant is reminded that any communication to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5).

Deborah D. Williams

Telephone: 703-305-3744

FORM PCT/DO/EO/903 (March 2001)

German Language Declaration

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem Patent- und Warenzeichenamt: *(Name und Registrationsnummer anführen)*

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

And I hereby appoint

Messrs. William E. Vaughan (Reg. No. 39,056); Robert M. Barrett (Reg. No. 30,142); Michael S. Leonard (Reg. No. 37,557); Patricia A. Kane (Reg. No. 46,446); Thomas C. Basso (Reg. No. P46,541); Robert W. Connors (Reg. No. P46,442); Troy A. Groetren (Reg. No. 46,442); Adam H. Masia (Reg. No. 35,602); Dante J. Picciano (Reg. No. 33,543); Amy J. Gast (Reg. No. 41,773); Timothy L. Harney (Reg. No. 38,174); Renato L. Smith (Reg. No. 45,117); and Alan L. Barry (Reg. No. 30,819)

Telefongespräche bitte richten an: *(Name und Telefonnummer)*

Direct Telephone Calls to: *(name and telephone number)*

(312) 807-4292
Ext. _____

Postanschrift:

Send Correspondence to:

William E. Vaughan
Bell, Boyd & Lloyd
P.O. Box 1135
Chicago, IL 60690-1135

Voller Name des einzigen oder ursprünglichen Erfinders: BENZ, Michael	Full name of sole or first inventor:
Unterschrift des Erfinders / Datum: 24 Feb 01	Inventor's signature / Date
Wohnsitz: D-13629 Berlin, Germany DEX	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Schuckertdamm 328	Post Office Addess
D-13629 Berlin Bundesrepublik Deutschland	
Voller Name des zweiten Miterfinders (falls zutreffend): BOLINTH, Edgar	Full name of second joint inventor, if any:
Unterschrift des Erfinders / Datum: Edgar Bolinth 05.03.01	Second Inventor's signature / Date
Wohnsitz: D-41189 Mönchengladbach, Germany DEX	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Rheindahlener Str. 88	Post Office Address
D-41189 Mönchengladbach Bundesrepublik Deutschland	

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).

Voller Name des dritten Miterfinders:	Full name of third joint inventor:
FÄRBER, Michael	
Unterschrift des Erfinders Datum: Michael Färber 10.2.01	Inventor's signature Date
Wohnsitz: D-82515 Wolfratshausen, Germany DEX	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Schießstättstr. 12 A D-82515 Wolfratshausen Bundesrepublik Deutschland	Post Office Address
Voller Name des vierten Miterfinders (falls zutreffend): KAMPERSCHROER, Michael	Full name of fourth joint inventor, if any:
Unterschrift des Erfinders Datum: 12/3/01	Inventor's signature Date
Wohnsitz: D-46499 Hamminkeln, Germany DEX	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Neustr. 11 a D-46499 Hamminkeln Bundesrepublik Deutschland	Post Office Address
Voller Name des fünften Miterfinders (falls zutreffend): KLEIN, Anja	Full name of fifth joint inventor, if any:
Unterschrift des Erfinders Datum: 6. Febr. 01	Inventor's signature Date
Wohnsitz: D-10709 Berlin, Germany DEX	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Paderborner Str. 8 D-10709 Berlin Bundesrepublik Deutschland	Post Office Address
Voller Name des sechsten Miterfinders (falls zutreffend): KOTTKAMP, Meik	Full name of sixth joint inventor, if any:
Unterschrift des Erfinders Datum: 6. Feb. 01	Inventor's signature Date
Wohnsitz: D-10585 Berlin, Germany DEX	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Schustehrusstr. 42 D-10585 Berlin Bundesrepublik Deutschland	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).

Voller Name des siebten Miterfinders:	Full name of seventh joint inventor:
SCHWARK, Uwe	
Unterschrift des Erfinders — Datum: 08.03.01	Inventor's signature — Date
Wohnsitz: D-46399 Bocholt, Germany DE	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Freiheitstr. 6 D-46399 Bocholt Bundesrepublik Deutschland	Post Office Address
Voller Name des achten Miterfinders (falls zutreffend): SITTE, Armin	Full name of eighth joint inventor, if any:
Unterschrift des Erfinders — Datum: 7 Feb 2001	Inventor's signature — Date
Wohnsitz: D-10405 Berlin, Germany DE	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Prenzlauer Allee 237 D-10405 Berlin Bundesrepublik Deutschland	Post Office Address
Voller Name des neunten Miterfinders (falls zutreffend): ULRICH, Thomas	Full name of ninth joint inventor, if any:
Unterschrift des Erfinders — Datum: 7 Feb 2001	Inventor's signature — Date
Wohnsitz: D-13505 Berlin, Germany DE	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Sandhauser Str. 109 B D-13505 Berlin Bundesrepublik Deutschland	Post Office Address
Voller Name des zehnten Miterfinders (falls zutreffend):	Full name of tenth joint inventor, if any:
Unterschrift des Erfinders — Datum	Inventor's signature — Date
Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).